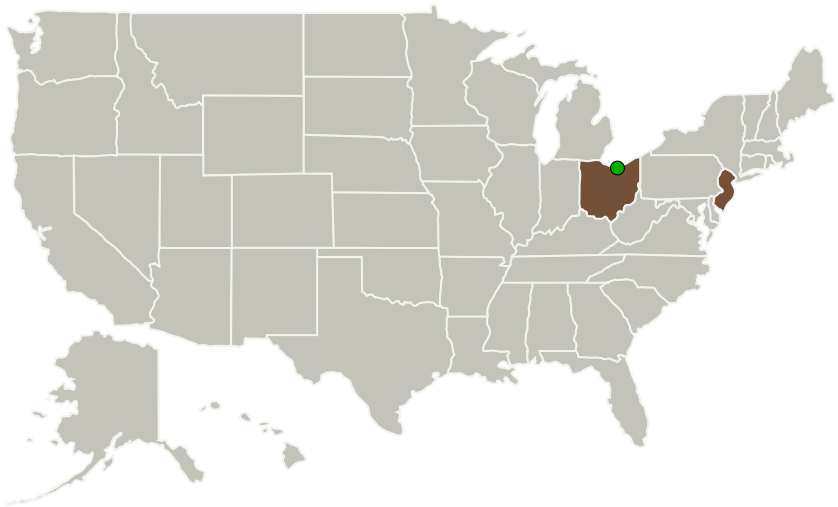
High Energy Density Li-Ion Batteries Enabled By a New Class of Cathode Materials, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

The proposed program addresses NASA's need for advanced battery technologies, and in particular the energy storage needs for Extravehicular Activities. The most advanced commercially available Li-ion batteries use intercalation-based cathode materials, where the energy density is limited by the oxidation states of the metal oxide and the availability of lithium ions. In contrast, non-oxide cathode materials based on conversion mechanism offer an opportunity to realize exceptionally high capacity. Literature reports suggest that an energy density in excess of 1200 Wh/kg is possible at the material level. However, it has been a challenge to obtain such high performance at the cell level in practical batteries. Building upon NEI's experience in synthesis, surface modification and functionalization of nanoscale materials, the Phase I program aims to demonstrate the commercial feasibility of a new class of Li-ion batteries that utilizes a unique cathode architecture. In Phase I, materials will be synthesized and assembled into cells, and electrochemically tested under parameters of relevance to NASA's EVA application. Sample cathode materials will be submitted to NASA at the end of the Phase I program. In Phase II, 2Ah capacity Li-ion cells with cell-level specific energy and energy density of 500Wh/kg and 1000 Wh/l, respectively, will be fabricated and delivered to NASA.

Primary U.S. Work Locations and Key Partners



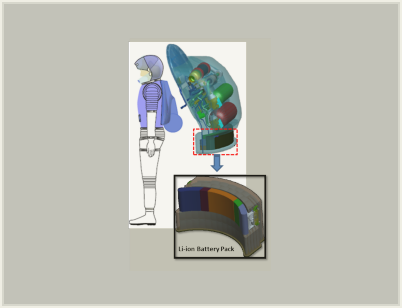


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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
NEI Corporation	Lead Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
New Jersey	Ohio

Project Transitions

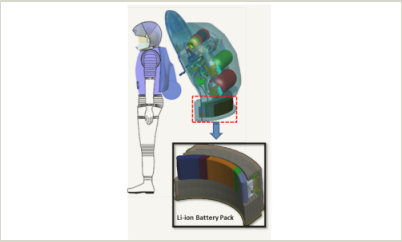
June 2016: Project Start

December 2016: Closed out

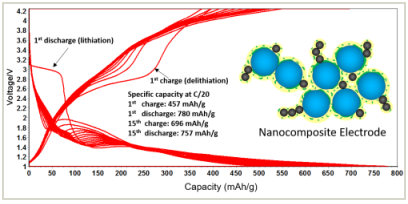
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139805)*

Images



Briefing Chart Image
High Energy Density Li-ion Batteries Enabled By a New Class of Cathode Materials, Phase I *(https://techport.nasa.gov/image/129180)*



Final Summary Chart Image
High Energy Density Li-ion Batteries Enabled By a New Class of Cathode Materials, Phase I Project Image *(https://techport.nasa.gov/image/128157)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
NEI Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

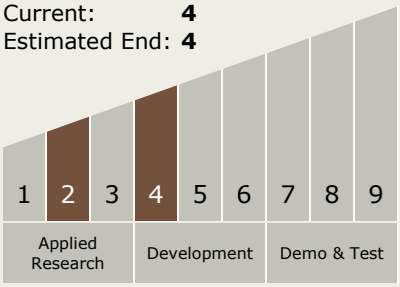
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Nader Hagh

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.1 Electrochemical: Batteries

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System